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A COMPARISON BETWEEN CALLAHAN and KNAPP PROCEDURE for HYPOTROPIA in DOUBLE ELEVATOR PALSY

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SUMMARY

Twenty six patients with double elevator palsy (DEP) (ranging from 25-90 PD), who had undergone either Callahan or Knapp-Modified-Kanpp Procedure from February, 1981 to February, 1994, were reviewed. We achieved acceptable results in correction of hypotropia in primary position. Three patients gained peripheral fusion and after reviewing the results we concluded that in patients having large-angle hypotropia with DEP, especially when it is accompanied by inferior rectus restriction. Callahan procedure is preferrable; however, in coexisting vertical-horizontal deviation, Modified-Knapp Procedure is recommended.

INTRODUCTION

Double elevator palsy means monocular elevation deficiency induction and version which may be congenital or acquired. The limitation of upward gaze may be the weakness of both elevator muscles (the superior rectus and inferior oblique muscles) due to innervation

factor or due to mechanical, restrictive factors, or a combination of them. Double evelvator is often associated with hypotropia and ptosis or pseudo ptosis of upper eyelid.

Material and Methods

The record of 26 cases of hypotropia with double elevator palsy (D.E.P) who were operated on, from February 1981 to Fbruary 1994 were reviewed. In this study the two techniques of knapp and Callahan procedures for evelvation of hypotropic eye were compared. All patients with at least 6 weeks of post operative follow-up were included in the study. The group consisted of 12 males and 14 females.

The age range was from 3 to 27 years, (mean 11.6 years). The etiology in 25 patients was congenital and in one case was trauma. All cases showed hypotropia in primary position with limitation of upward gaze.

In one patient double evelvator palsy was bilateral (case No. 10) and in one case ptosis was with. Marcus gunn Jaw winking phenomenon (case No. 4) 13 cases had associated horizontal deviation. 11 cases had extropia and 2 cases had esotropia, the mean preoperative deviation in hypotropia was 43.8 P.D. (range, 25-90 P.D.). In exotropia was 28.27 P.D. (range, 5-65 P.D.). All patients underwent binocular vision testing (worth 4 dot test + Titmus stereotest), and none proved to meet binocular vision criteria. 12 cases were operated on with knapp procedure or a modification of it. The horizontal recti were transposed to the insertion of superior rectus as to straddle it (fig. 1A). Ineight cases a significant horizontal deviation was present, so we did a modified knapp procedure with appropriate amounts of horizontal rectus recession and resection. Where a muscle was recessed, the point of reattachment was measured from the superior rectus insetion. (fig. 1B).

14 Cases underwent the Callahan procedure, in which the horizontal recti and supeior rectus are split without disinsertion and are joined with a nonabsorbable suture in a similar manner to the Jensen procedure of lateral rectus palsy (fig 2).

All cases in which the traction test was positive Inferior rectus was recessed. Pseudo ptosis eliminated after surgery on vertical muscles and in those with true ptosis levator muscle resection (4 cases including the patient Marcusgunn Jaw winking phenomenon) was performed.

Results

In all 26 cases, the hypotropia was reduced as a result of planned surgery (Table 1). The correction of vertical deviation in Callahan procedure ranged fron 20 to 90 PD (average 48. P.D) and in Knapp-Modified Knapp procedures ranged from 14 to 40 P.D (average 33.7 P.D). The horizontal deviation was reduced in

Table 1. A comparison between callahan and knapp procedure-results

Case No./ Age (yrs)/ Sex	Corrected C.A R L	Ehtiology	Pre Op.deviation (Prism diopters)	Surgery	tractiontest	Post Op.deviation	Correction (prsim diopters	Follow up
1/27/M	C.F 20/20	Cong.D.E.P. with ptosis in RE	R hypo 50 R exo 5	R Callahan Procedure +I.R. Rec 6mm +Levat. Res. 18m	+	Straight in primary position	50 R hypo	one year
2/9/F	20/20 20/30	Cong.D.E.P. with ptosis in KE	R hypo 50	R Callahan procedure +I.R Rec 5mm +Levat. Res. 16mm	+	orthophoria in cardinal gazes (peripheral fusion)	50 R hypo	8 year
3/9/F	20/40 20/25	Cong.D.E.P. with ptosis in RE	R hypo 65 R eso 2	R Callahan Procedure +I.R. Rec 5mm +Levat. Res. 16mm	+	No vertical R eso 30	65 R hypo R eso increased	week
4/7/F	20/20 20/50	Cong.D.E.P. with in LE (marcus gunnijaw winking syn.)	L hypo 70	L Callahan procedure +I.R. Rec 6mm +L evat. excision +Frontalis supension	No verticcal (Peripheral fusion)	esophoria	70 L hypo	one year
5/13/F	C.F. 20/20	Cong.D.E.P. with ptosis in RE	R hypo 30	R Callahan procedure +Frontalis supension	+	mild R hypo	#25 R hypo	6 weeks
6/13/F	C.F. 20/20	Cong.D.E.P. with minimal ptosis in RE	L hypo 50	L Callahan procedure +I.R. Rec 5mm	+	No vertical L exo 25	50 L hypo L exo increased	6 months
7/9/M	20/60 20/60	Cong.D.E.P. with ptosis in lE	L hypo 50 L exo 10	L Callahan procedure +I.R. Rec 5mm +Frontal is suspension	+	No Vertical	50 L hypo L exo 20 increased	one year

Table 1. Continued

Case No./ Age (yrs)/ Sex	Corrected C.A R/L	Ehtiology	Pre Op.deviation (Prism diopters)	Surgery	tractiontest	Post Op.deviation	Correction (prsim diopters	Follow up
8/13/M	20/20 C.F.	Cong.D.E.P. with pseudoptosis in LE	L hypo 40 L exo 10	L Callahan procedure	Not done	L hypo 20	20 L hypo	6 weeks
9/3/M	20/20 20/200	Traumatic DEP with ptosis in LE	L hypo 90	L Callahan procedure +I.R.Rec. 8mm +Levat Res 18mm	-	exophoria	90 L hypo	3 years
10/18/F	20/20 20/200	Cong. Bilateral D.E.P+Ptosis o.u	L hypo 35	Callahan procedure o.u+R I.R Rec 7mm +L I.R. tenotomy +Frontalis supension o.u	+	hypo o.u	#25 hypo	5 months
11/16/F	20/20 20/30	Cong.D.E.P. with ptosis in LE	L hypo 40 L exo 25	L Callahan Procedure o.u+R I.R Rec 7mm +L I.R. tenotomy Frontalis suspension o.u	+	L exo 6	40 L hypo 19 L exo	6 months
12/4.50/F	20/20 C-F	Cong. D.E.P. with pseudo ptosis in LE	R hypo 60	R Callahan +R.I.R. Rec 6mm	+	R hypo 18	42 R hypo	6 months
13/8/F	20/40 C.F	Cong.D.E.P. with ptosis in LE	L hypo 30 L exo 45	L Modified knapp (R L.R Rec 8mm R M.R Res 6mm+	-	L hypo 16	L 14 hypo L 45 exo	2 months
14/5/M	20/30 20/30	Cong.D.E.P. with pseudoptosis in RE	R hypo 45 R exo 40	R Modified knapp procedure (R.L.R Rec 8mm) (R.L.R Rec 8mm) (+R.M.R Res. 6mm)	-	R hypo 20	R 25 hypo R 40 exo	2 months

Table 1. Continued

Case No./ Age (yrs)/ Sex	Corrected C.A R/L	Ehtiology	Pre Op.deviation (Prism diopters)	Surgery	tractiontest	Post Op.deviation	Correction (prsim diopters	Follow up
15/5/M	20/70 20/30	Cong.D.E.P. with pseudoptosis in RE	R hypo 35	Knapp procedure	-	R hypo 6	R 29 hypo	2 months
16/21/F	20/20 20/100	Cong.D.E.P. with exotropia in LE	L hypo 50 L exo 65	First L Modified OP Knapp procedure (L.LR. Rec 10mm) (L.M.R. Rec. 6mm+) +L.I.R. Rec 5mm) Secong op RE (R+R)	-	L hypo 20	L 30 hypo L 40 exo	7 months
17/25/F	20/20 20/80	Cong.D.E.P with L.R Paresis in LE	L hypo 35	L Modified knapp Procedure (L.M.R Rec 5mm) (L.L.R Rec 6mm+) +L.I.R Rec 4mm) +Temporal displace ment	-	No Vertical L exo 5	L 35 hypo L 30 eso	6 weeks
18/5.50/F	20/60 20/50	Cong.D.E.P. with pseudoptosis in RE	R hypo 45	knapp procedure	-	No vertical L exo 5	L 35 hypo L 30 eso	3 months
19/6/M	20/40 20/70	Cong.D.E.P. with pseudoptosis in LE	L hypo 30 L exo 20	L Modified knapp procedure (L.M.R. Res 6mm)	-	improved	L 30 hypo L 20 exo	one year
20/16/F	20/18 20/20	Cong.D.E.P. with ptosis in RE	R hypo 25 R exo 16	R Modified knapp Procedure (R.M.R Res. 6mm) +Levat. Res. 12mm)	-	onthophoria (Peripheral- Fusion)	R 25 hypo R 16 exo	2 years

Table 1. Continued

Case No./ Age (yrs)/ Sex	Corrected C.A R/L	Ehtiology	Pre Op.deviation (Prism diopters)	Surgery	tractiontest	Post Op.deviation	Correction (prsim diopters	Follow up
21/6/M	20/30 20/60	Cong.D.E.P. with ptosis in LE	L hypo 25 L exo 35	L Monified knapp Procedure (L.M.R. Res. 6mm)	-	No vertical L exo 25	L 25 hypo L 10 exo	2 months
22/12/M	20/20 20/200	Cong.D.E.P. with ptosis in LE (mild)	L hypo 35 L eso 10	L Callahan Procedure +L E.R. Rec 3mm	+	orthotropia inprimary Position	35 L hypo	4 years
23/6/M	20/100 20/20	Cong.D.E.P. in RE	R hypo 45	RE knapp Procedure	-	orthotropia inprimary	45 R hypo position	4 years
24/8/F	20/25 C.F	Cong.D.E.P with exotropia in LE	L hypo 30 L exo 40	L Modified Knapp procedure (L.L.R. Rec 8mm) +L.M.R.Res 6mm)	-	L hypo 16 No horizontal	14 L hypo 40 L exo	4 years
25/19/F	20/40 20/40	Cong.D.E.P. with ptosis in LE	L hypo 45 +Ptosis 6mm	L Callahan procedure+ L.E.R. Rec 4mm +Levat.Res. 20mm	+	orhtotropia in primary position	45 L hypo	2 years
26/51/2/M	20/25 20/20	Cong.D.E.P. in RE	R hypto 35	R knapp procedure	-	R hypo 6	28 R hypo	5 years

I.R= Inferior rectus
hypo= hypotropia
Cong= Congential

M.R= Medial rectus
(R+R)= Rcession+Resection
Levat.= Levator muscle

L.R= Lateral rectus
Eso= esotropia
exo= exotropia
orthotropia= no deviation
in primary position

D.E.P= Double elevator Palsy
Rec= Recession
Res= Resection
orthophora= no deviation
in primary position with fusion

Modified-Knapp procedure ranging from 10 to 45 P.D. in exotropia and 30 P.D. in esotropia. In only one patient 5 P.D. overcorrection of esotropia was noted which increased to 22 P.D. exotropia in long term follow-up. In three patients after Callahan procedure the coexisting horizontal deviation was increased. (Table 1). Two patients after Callahan and one patient after Modified Knapp procedure gained peripheral fusion at primary position. One patient (case No.2) who had underwent Callahan procedure, was orthophoric in all cardinal gazes with no limitation in upward gaze.

Discussion

In 1969 Knapp reported a correction of 231 to 55 P.D. (mean 38 P.D) (5) of vertical deviation in double elevator palsy by transposing the horizontal recti to the insertion of superior rectus muscle.

In two cases the inferior rectus had also recessed. He noted that by this approach even with the correction of hypotropia in primary position, it had little effect on horizontal gazes and the ability of upward gaze remained poor. In 1971 Dunlap (4) published 22 cases of Double levator underaction in whom 16 had supraplacement of horizontalrecti and 6 patients had additional recession/resection of transposed muscles. In general, several authors have contributed to the formulation of D.E.P. correction, including O/Neils, (9) vonNoorden (11) and Metz (8). The last one, in his communication in 1988, (8) has come to this conclusion that there is approximately 1 P.D correction of vertical strabismus per millimeter of horizontal recti displacement, but he admits that in large angle vertical deviations, transposition of horizontal recti may not reduce the strabismus sufficiently. In 1979, Scott and Jackson (10) drew the attentions to the high incidence of inferior rectus restriction in cases with D.E.P. (11 out of 15) which could be determined by a deficient Bell's phenomenon and accentuation of the lower lid fold on attempted upgaze of the affected eye. In the same year, this finding was confirmed by Metz (7) who found a 50% chance of positive forced duction test, when hypotropia with D.E.P Was present. Again, this was confirmed in our study, that from 26 patients, who had positive traction test, one was excluded as it had not been tried for traction test at all.

In 1981, Callahan (2) proposed a new approach to the correction of hypotropia eyes with D.E.P. In his procedure, superior and horizontal recti were split and united similarly to the Jensen procedure, Inferior rectus recession was also performed. His rationale was that with this approach, the chance of anterior segment ischemia would be diminished, as the recti were not disinserted. This is really true in elderly patients and in those hypotropic eyes with positive traction test. The average correction of

hypotropia in D.E.P. was 38 P.D in Knapp's original report, 31.7 P.D. in Barsoum Homsy (1) series, 21 P.D> in Lee series and 26.6 P.D in Cooper and Greenspan (3) report, by Knapp procedure. Our result in correction of hypotropia with Knapp-Modified Knapp procedure averaged 33.7 P.D which is in agreement with previous reports.

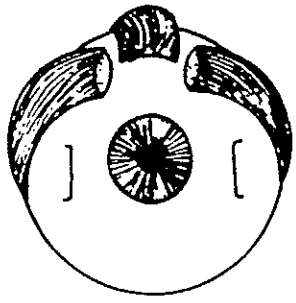

Fig. 1 A. Knapp procedure

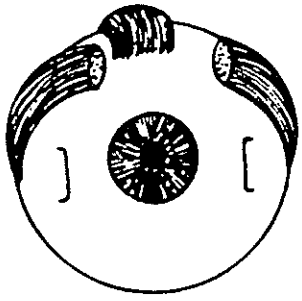

Fig. 1 B. Modified Knapp procedure

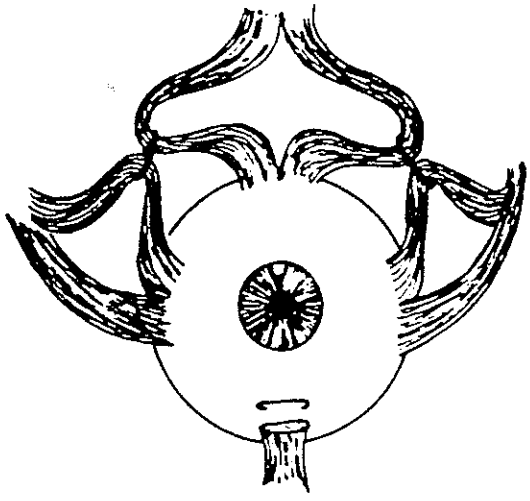

Fig. 2. Callahan procedure

But in Callahan procedure the average correction of hypotropia was 48 P.D. including one patient with 90 P.D correction and elimination of hypotropia in primary position. To the best of our knowledge, our Callahan series has no counterpart in English literature and this is our impression that this procedure could be highly recommended in patients with

large an gle hypotropia with E.E.P, particularly in those with positive traction test who need inferior rectus recession as well. This is in accordance with Metz statement that where hypotropia is due to mechanical origin, horizontal rectus transposition is not indicated. However, since coexisting horizontal deviation with hypotropia may increase after Callahan procedure, probable Modified Knapp procedure is preferrable for correction of vertical and horizontal deviations, simultaneously.

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